

What is claimed is:

1. A computer system for configuring a machine to automatically perform a method of isolating nucleic acid, the computer system comprising:

a computer;

a computer readable medium comprising machine readable instructions for

causing the computer to output a command series to an automated

nucleic acid isolation machine for control of the functions of nucleic

acid isolation process;

wherein the computer readable medium further comprises:

a software module comprising:

a centrifuge sub-module for issuing commands initiating centrifuging

of a sample for a centrifuge time and a centrifuge speed;

an aspirate sub-module for issuing commands initiating aspirating a sample to

remove a volume of fluid from a sample;

a mixing sub-module for issuing commands initiating mixing a

sample; and

a dispensing sub-module for issuing commands initiating dispensing

into a sample an amount of a specific reagent.

2. The computer system of claim 1, and further comprising:

a graphical user interface for selecting a sequence of commands to be output

by the computer.

3. The computer system of claim 1, wherein the command series comprises:
- loading a vessel containing a biological blood sample into a centrifuge;
  - centrifuging the sample for a predetermined time and at a predetermined g-force;
  - removing excess supernatant from the centrifuged sample;
  - mixing the sample by aspirating and dispensing a predetermined quantity of sample
    - at a selectable aspiration rate from gentle to vigorous a predetermined number of times;
  - dispensing into the biological sample a predetermined quantity of a first reagent;
  - mixing the sample by aspirating and dispensing a predetermined quantity of sample
    - at a selectable aspiration rate from gentle to vigorous a predetermined number of times;
  - dispensing into the sample a predetermined quantity of a second reagent;
  - mixing the sample by aspirating and dispensing a predetermined quantity of sample
    - at a selectable aspiration rate from gentle to vigorous a predetermined number of times;
  - centrifuging the sample for a predetermined time and at a predetermined g-force;
  - removing excess supernatant from the sample;
  - transferring the remaining material to a second vessel containing a predetermined volume;

mixing the sample by aspirating and dispensing a predetermined quantity of sample  
at a selectable aspiration rate from gentle to vigorous a predetermined  
number of times;

centrifuging the sample for a predetermined time and at a predetermined g-force;

removing excess supernatant from the sample;

dispensing into the sample a predetermined quantity of a third reagent;

mixing the sample by aspirating and dispensing a predetermined quantity of sample  
at a selectable aspiration rate from gentle to vigorous a predetermined  
number of times;

centrifuging the sample for a predetermined time and at a predetermined g-force;

removing a predetermined quantity of material from the sample; and

dispensing into the sample a predetermined amount of a fourth reagent.

4. The computer system of claim 3, wherein the command series further comprises  
removing and storing the sample vessel.

5. The computer system of claim 3, wherein the command series further comprises  
dispensing additional reagents as necessary.

6. The computer system of claim 1, wherein the computer readable medium comprises:  
a control module comprising:

a program module comprising a set of machine readable instructions for

issuing commands to the automated nucleic acid isolation apparatus to perform a series of steps, comprising:  
centrifuging a sample;  
removing a sample;  
mixing a sample; and  
adding a reagent to the sample.

7. The computer system of claim 6, wherein the control module is implemented in a dedicated processor.
8. The computer system of claim 6, wherein the program module is burned into a processor in hard code.
9. The computer system of claim 6, wherein the program module is implemented in a programmable logic controller.
10. The computer system of claim 1, wherein the computer readable medium comprises a control module, the control module comprising:  
a plurality of sub-modules, each sub-module comprising machine readable instructions for creating a command to the nucleic acid isolation apparatus to perform a process step of the nucleic acid isolation process; and  
an output link for communicating the commands to the nucleic acid isolation

apparatus.

11. The computer system of claim 10, wherein the plurality of sub-modules comprises:
  - a centrifuge sub-module for issuing commands initiating centrifuging of a sample for a predetermined time and speed;
  - a removal sub-module for issuing commands initiating removing a volume of fluid from a sample;
  - a mixing sub-module for issuing commands initiating mixing a sample; and
  - a dispensing sub-module for issuing commands initiating dispensing into a sample an amount of a specific reagent.
12. The computer system of claim 10, and further comprising a user input/output interface for programming a process comprising a plurality of invocations of the various sub-modules of the computer module.
13. The computer system of claim 10, wherein each of the sub-modules is configured to accept input of values for issuing commands.
14. The computer system of claim 1, wherein the command series comprises:
  - dispensing into a sample in a first vessel a predetermined quantity of a first reagent;
  - mixing the sample;

centrifuging the sample;  
removing excess supernatant from the centrifuged sample;  
dispensing a predetermined quantity of a second reagent into the sample;  
dispensing a predetermined quantity of a third reagent into the sample;  
mixing the sample;  
centrifuging the sample;  
transferring a supernatant fraction of the sample containing nucleic acid to a second vessel;  
dispensing a fourth reagent into the fraction of the sample;  
mixing the fraction of the sample;  
centrifuging the fraction of the sample;  
dispensing a fifth reagent to the fraction of the sample;  
mixing the fraction of the sample;  
centrifuging the fraction of the sample;  
dispensing a sixth reagent into the fraction of the sample;  
mixing the fraction of the sample; and  
centrifuging the fraction of the sample.

15. The computer system of claim 14, wherein mixing comprises rotating a predetermined number of times at a predetermined rate.

16. The computer system of claim 14, wherein centrifuging comprises:

loading a vessel containing a sample into a centrifuge;

centrifuging the sample for a predetermined time and speed; and

unloading a vessel containing a biological sample after centrifugation.

17. A computer readable medium for controlling the operation of an automated machine, the computer readable medium comprising machine readable instructions for causing a computer to perform a method comprising:

issuing a command set to initiate a plurality of nucleic acid isolation functions by a nucleic acid isolation apparatus, wherein the nucleic acid isolation functions comprise:

loading a vessel into a centrifuge;

centrifuging a sample;

aspirating a sample;

mixing a sample;

dispensing into a sample;

controlling the temperature of a function;

removing material from a sample;

separating a sample; and

removing and separating a sample.

18. The computer readable medium of claim 17, wherein controlling the temperature of a function is chosen from a group consisting of heating a sample, cooling a sample, heating a reagent, cooling a reagent, heating while performing a nucleic acid isolation function, and cooling while performing a nucleic acid isolation function.

19. The computer readable medium of claim 17, wherein removing material from sample is done by a method chosen from a group consisting of aspirating, pouring and saving, and pouring and discarding.

20. The computer readable medium of claim 17, wherein separating a sample is done by a method chosen from a group consisting of centrifugation, magnetic capture, electrical charge, gravity, affinity capture, hybridization capture, pressure, vacuum, forced liquid, and forced gas.

21. The computer readable medium of claim 17, wherein removing and separating a sample is done by a method chosen from the group consisting of washing, filtering, and flow through.

22. A computer system for configuring a machine to automatically perform a method of isolating nucleic acids, the computer system comprising:

- a computer;

- a computer readable medium comprising machine readable instructions for causing the computer to output a command series to an automated nucleic acid isolation machine for control of the functions of nucleic acids isolation process;

- wherein the computer readable medium comprises:

- a software module comprising:

- a centrifugation sub-module for issuing commands initiating centrifuging of a sample for a centrifuge time and a centrifuge speed;

- a mixing sub-module for issuing commands initiating mixing a sample;

- a dispensing module for issuing commands initiating dispensing into a sample an amount of a specific reagent;

- a temperature control module for issuing commands to control the temperature of a function;

- a removal module for issuing commands to remove material from a sample;



a separation module for issuing commands to separate a sample into components; and

a combination removal and separation module for issuing commands to control separating and removing a sample.

23. The computer system of claim 22, and further comprising:  
a graphical user interface for selecting a sequence of commands to be output by the computer.

24. A control module for controlling the operation of an automated nucleic acids isolation apparatus, the module comprising:  
a processor; and  
a program module comprising a set of machine readable instructions for issuing commands to the automated nucleic acids isolation apparatus to perform a series of steps, comprising:

centrifuging a sample;  
mixing a sample;  
adding a reagent to the sample;  
controlling the temperature of an isolation function;  
removing material from a sample;  
separating a sample; and  
separating and removing a sample.

25. The control module of claim 24, wherein the control module is implemented in a computer readable medium.

26. The control module of claim 24, wherein the control module is implemented in a dedicated processor.

27. The control module of claim 24, wherein the program module is burned into the processor in hard code.
28. The control module of claim 24, wherein the program module is implemented in a programmable logic controller.
29. A computer control module for an automated nucleic acids isolation apparatus, the control module comprising:
- a plurality of sub-modules, each sub-module comprising machine readable instructions for creating a command to the nucleic acids isolation apparatus to perform a process step of the nucleic acids isolation process; and
  - an output link for communicating the commands to the nucleic acids isolation apparatus;
- wherein the plurality of sub-modules comprises:
- a centrifuge sub-module for issuing commands initiating centrifuging of a sample for a centrifuge time and a centrifuge speed;
  - a mixing sub-module for issuing commands initiating mixing a sample;
  - a dispensing module for issuing commands initiating dispensing into a sample an amount of a specific reagent;
  - a temperature control module for issuing commands to control the temperature of a function;
  - a removal module for issuing commands to remove material from a sample;
  - a separation module for issuing commands to separate a sample into components;
- and
- a combination removal and separation module for issuing commands to control separating and removing a sample.

30. The computer module of claim 29, and further comprising  
a user input/output interface for programming a process comprising a plurality of  
invocations of the various sub-modules of the computer module.
31. The computer module of claim 29, wherein each of the sub-modules is configured  
to accept input of values for issuing commands.
32. The computer control module of claim 31, wherein the control module is  
implemented in a machine readable medium comprising a set of machine readable  
instructions.
33. The computer module of claim 29, wherein the control module is implemented in a  
dedicated processor.
34. A computer system for configuring a machine to automatically perform a method of  
isolating nucleic acid, the computer system comprising:  
a computer;  
a computer readable medium comprising machine readable instructions for  
causing the computer to output a command series to an automated  
nucleic acid isolation machine for control of the functions of nucleic  
acid isolation process;  
wherein the computer readable medium further comprises:  
a software module comprising:  
a centrifuge sub-module for issuing commands initiating centrifuging  
of a sample for a centrifuge time and a centrifuge speed;  
a removal sub-module for issuing commands initiating removing from a sample

container volume of fluid from a sample;  
a mixing sub-module for issuing commands initiating mixing a  
sample; and  
a dispensing sub-module for issuing commands initiating dispensing into a  
sample an amount of a specific reagent;  
wherein each sub-module except the centrifugation sub-module is configured to  
control operation external to a centrifuge.

35. The computer system of claim 34, wherein the computer readable medium comprises:  
a control module comprising:

a program module comprising a set of machine readable instructions for  
issuing commands to the automated nucleic acid isolation apparatus to  
perform a series of steps, comprising:  
centrifuging a sample;  
removing a sample;  
mixing a sample; and  
adding a reagent to the sample.

36. A computer readable medium for controlling the operation of an automated  
machine, the computer readable medium comprising machine readable instructions for  
causing a computer to perform a method comprising:

issuing a command set to initiate a plurality of nucleic acid isolation functions by a  
nucleic acid isolation apparatus, wherein the nucleic acid isolation functions comprise:  
loading a vessel into a centrifuge;

centrifuging a sample;  
mixing a sample;  
dispensing into a sample;  
controlling the temperature of a function;  
removing material from a sample;  
separating a sample; and  
removing and separating a sample.

37. The computer readable medium of claim 36, wherein removing material from sample is done by a method chosen from a group consisting of pouring and saving and pouring and discarding.

38. A computer system for configuring a machine to automatically perform a method of isolating nucleic acids, the computer system comprising:

a computer;

a computer readable medium comprising machine readable instructions for causing the computer to output a command series to an automated nucleic acid isolation machine for control of the functions of nucleic acids isolation process;

wherein the computer readable medium comprises:

a software module comprising:

a centrifugation sub-module for issuing commands initiating centrifuging of a sample for a centrifuge time and a centrifuge speed;

a mixing sub-module for issuing commands initiating mixing a sample;

a dispensing module for issuing commands initiating dispensing into a sample an amount of a specific reagent;

a temperature control module for issuing commands to control the temperature of a function;

a removal module for issuing commands to remove material from a sample;

a separation module for issuing commands to separate a sample into components; and

a combination removal and separation module for issuing commands to control separating and removing a sample.

39. The computer system of claim 38, wherein the system operates on samples having a sample volume of approximately 10 milliliters.

40. The computer system of claim 38, wherein the system operates on samples having a sample volume of up to 50 milliliters.

41. A method of defining a protocol for automated isolation of DNA by an apparatus for DNA isolation using a software module having a plurality of DNA isolation sub-modules, the method comprising:  
selecting a sub-module;  
selecting an operational sequence for the selected sub-module;  
defining the sub-module specific parameters; and  
repeating selecting a sub-module through defining the sub-module parameters until the desired protocol is complete.

42. The method of claim 41, and further comprising:  
re-ordering the sub-module execution sequence after the desired protocol is complete.

43. The method of claim 41, wherein the sub-modules comprise:  
a centrifuge sub-module for issuing commands initiating centrifuging of a sample for a centrifuge time and a centrifuge speed;

an aspirate sub-module for issuing commands initiating aspirating a sample to  
remove a volume of fluid from a sample;  
a mixing sub-module for issuing commands initiating mixing a  
sample; and  
a dispensing sub-module for issuing commands initiating dispensing into a  
sample an amount of a specific reagent.

44. The method of claim 41, wherein the method is usable on samples having a sample volume of approximately 10 milliliters.

45. The method of claim 41, wherein the method is usable on samples having a sample volume of up to 50 milliliters.

46. A method of defining a protocol for automated isolation of DNA from a sample of up to 50 milliliters by an apparatus for DNA isolation using a software module having a plurality of DNA isolation sub-modules, the method comprising:

selecting a sub-module;  
selecting an operational sequence for the selected sub-module;  
defining the sub-module specific parameters; and  
repeating selecting a sub-module through defining the sub-module parameters  
until the desired protocol is complete.